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Agricultural Research Institute, Pusa

Design for Farm Buildings

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Design for Farm Buildings

(Received for publication on the 13th August 1928.)

Bulletin No. 174 of this Institute deals with the Unit System of Farm Buildings. Full details are given of the type shed consisting of steel scantlings and galvanized sheets. By using this system, an economical and efficient type of construction is provided. Where complete sheds made by engineering firms are purchased, the overhead charges bring the cost up to a high figure. Under the method described, the cost is a little more than the market value of bulk steel and galvanized sheets.

Another great advantage is portability. There is very little masonry involved and the whole buildings can be dismantled and removed in the case where the farm is not required to be permanent.

The costs of repairs are nominal.

It has been suggested that designs and specifications for a complete range of farm buildings should be worked out and the following bulletin gives the layout of a typical farm. This can be modified according to circumstances and combines economy with efficiency. The following description is suitable for a farm steading for 25 cows and their followers.

The cropping mentioned below is based on the system at present carried out on the Pusa Farm and the farm steading is fully equipped for a self-contained unit providing all the food required for the cattle.

Farm area. The area of the Farm mentioned is a hundred acres arable, unirrigated, with 8 acres under a well for cold weather and hot weather fodder. Roads, buildings and exercise paddocks will amount to 12 acres, or total of about a 120 acres. No grazing ground has been provided and the cattle get their grazing from catch crops grown on the arable land.

Rotation. The rotation is as follows:—

—	1st year	2nd year	3rd year
	33 acres	33 acres	34 acres
Kharif . .	Maize for fodder and silage.	Maize for cobs .	Legumes for grazing.
Rabi . .	Oats . . .	*Arhar* or grams or peas.	Oats ½. Wheat ½.

Farmyard manure is applied to 1st year rotation at 10 tons per acre.

Livestock. The livestock provided for are :—

Variety of cattle	Number of cattle
Stud bull	1
Cows	25
Young stock	40
Work cattle	16
TOTAL	82

Rotation. The concentrated ration required per annum is as follows :—

Animals	Quantity of ration needed Md.
Stud bull	20
Cows	500
Young stock	400
Work cattle	200
TOTAL	1,120

This ration consists of the grains grown on the Farm, ground up and fed as a mash. The grain produced annually from the above rotation will be :—

Grain	Yield Md.
Oats	700
Wheat	300
Maize	300
Pulses	250
TOTAL	1,550

If any grain is sold off the Farm, oil-cake will have to be purchased to take its place.

In addition to the grazing of catch crops, maize or in some cases *Jowar*, is sown for silage making. 3,600 maunds of silage can be made per annum. In addition, green maize choped is provided, about 3,000 maunds annually.

Fodder. The grain crops will produce 2,000 maunds of "bhusa" or straw to be fed throughout the year. *Bhusa* sheds are provided for all "bhusa" and three "Katcha" rectangular silage pits are required, to hold 1,200 maunds silage each.

Machinery. The major items of machinery required are :—

One tractor,

One three-foot-drum grain threshing machine,

One power driven silage cutter.

Specifications of buildings. Full details and drawings of buildings are given below and are self-explanatory. The only item that calls for comment is the milk-cowshed. The design given is an exceedingly cheap one. If a modern shed which will display the cows better is required, the expense will be considerably increased. A passage down the middle of the cowshed with double rows and feeding troughs and steel travises would look very much better, but the cost of such a building is considerably greater. The design given has been found in practice suitable for Indian cattle.

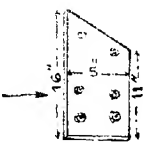
It must be noticed that the principles applied to farm building design in temperate countries must be considerably modified for tropical work. In Europe labour is very much more expensive than in India so that there, it is of vital importance to provide economy of labour in handling animals and foodstuffs. For India it is essential to get as much light and air as possible in all the buildings. Animals well fed do not require to be shut up in stuffy buildings. The more open air the livestock get both in the cold weather and in the hot weather, the more healthy the animals will be.

It should be noted that the farm plan can be modified to almost any extent as there are only two type sheds and these two types only vary between themselves in the height of the columns. Godowns are converted from sheds by filling in the space between columns with single brickwork. Necessary doors are made of expanded metal with angle iron frames.

1. GENERAL SPECIFICATIONS OF ONE UNIT OF PORTABLE SHED. "A" & "B" TYPES.

One unit 18′ 6″ span and 10′ 0″ length consisting of 2 columns and a curved rafter.

1(*a*) Columns 2 (Overall—Unit "A" 9′ 11″ and "B" 15′ 5″ above ground level—Unit "A" 6′ 11″ and "B" 12′ 3″).

	lb.
Rolled steel beams 9′ 11″×7″×4″ @ 16 lb. per ft. including drilling six $\frac{5}{8}$ inch holes	320
(*b*) *Base plates* 2. Sheet iron (One for each column) 12″×12″ ×$\frac{1}{4}$″ @ 10·2 lb. including drilling four $\frac{5}{8}$″ holes in each plate	20
(*c*) Cleats for base plates 4.  No. 2×2 (3″×3″×$\frac{1}{4}$″×5″) @ 4·9 lb. rft. including 4 holes in each	8
(*d*) Rivets for base plates 12. 2×6 ($\frac{5}{8}$″ diam.×1$\frac{1}{2}$″) @ 23·7 lb. per cent.	3
(*e*) Head plates 4.  Sheet iron 2×2×$\frac{16″+11″}{2}$×5″×$\frac{1}{4}$″ @ 10·2 lb. sft. and six holes in each	20

2. *Principal rafter (curved) 1—*

(*a*) Angle iron curved rafter 1 (in two pieces). 22′×3″×3″×$\frac{3}{8}$″ @ 7·18 lb. including sixteen $\frac{5}{8}$″ holes . . .			158
(*b*) Cleats 4. Angle iron 4× 5′×3″×$\frac{3}{8}$″×6″ @ 9·72 lb. rft. .			19
(*c*) Central joint cleat 1 (for pieces of principal rafter). Angle iron 1×(10″×2$\frac{1}{2}$″×2$\frac{1}{2}$″×$\frac{5}{16}$″) @ 4·98 lb. rft. .			4
(*d*) Bolts and nuts $\frac{5}{8}$″ diam. ×1$\frac{1}{2}$″ long, 34—			
Head plates 2 (4+2) . .	12		
Central joint (4+2) . .	6		
Cleats 4 (2+2) . . .	16		
TOTAL .	34	@ 58 lb. per cent.	20

3. *Purlins 4*— lb.

Angle iron 4 × 10′ (3″ × 3″ × $\frac{1}{4}$″) @ 4·9 lb. rft. including drilling two $\frac{5}{8}$″ holes in each 196

4. *Roofing materials*—

(*a*) Galvanized corrugated iron sheets—

Span 23′ 2″ *plus* lappage (5″ ÷ 5″) 10″ = 24 ft., Length 10′ + (3 lappages of 6″) 1$\frac{1}{2}$′ = 11$\frac{1}{2}$ ft.

Area of roof 276 sft. @ 1·5 lb. sft. including bending 13 sheets 8′ × 2′ 8″ 414

(*b*) Galvanized hook bolts and nuts 5″ × $\frac{3}{8}$″ diam., 4 × 4 = 16 @ 25 lb. per cent. 4

(*c*) Galvanized slot head bolts and nuts $\frac{3}{4}$″ × $\frac{1}{4}$″, 15 × 4 = 60 . No. 60

(*d*) Limpet washers, galvanized, 1$\frac{1}{4}$″ diam., 16 + 60 . . . 76

2. SPECIFICATION FOR "BHUSA" BARN.

This has higher columns than the other sheds and is constructed of *ten units* of "B" type. The height is 12 feet to caves whereas it is only 6 ft. 6 in. in case of the buildings of "A" type. This is a very simple open shed and therefore need not be described at length. It will cost about rupees two thousand and five hundred according to the estimate given below :—

	Rs.	A.	P.
1. Earthwork excavation for foundation Foundation of columns $11 \times 2 \times 1'\ 9'' \times 1'\ 6'' \times 3' = 173$ cft. @ Rs. 4 (°/₀₀)	0	11	0
2. Concrete in cement mortar in foundation— Foundation of columns as above, 173 cft. @ Rs. 55 per cent.	95	2	0
3. Iron work per unit, each unit to follow detailed specifications already given. 10 units of "B" type @ lump sum Rs. 197/ each f.o.r., Howrah	1,970	0	0
3-A. An extra pair of columns and a curved rafter to above specifications @ lump sum Rs. 100, f.o.r., Howrah	100	0	0
4. Railway freight on iron work from Howrah to Pusa Road per goods train lump sum	180	0	0
5. Erection charges of 10 units, lump sum	37	0	0
6. Fixing and fitting sheets on roof. Labour only. Whole shed $1 \times 102' \times 23'\ 2'' = 2,363$ sft. @ Rs. 3-8, per cent. .	82	11	0
7. Site cleaning, lump sum	2	0	0
TOTAL .	2,467	8	0

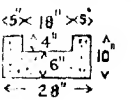
(Rupees two thousand, four hundred and sixty seven and annas eight only.)

3. SPECIFICATION FOR WORK BULLOCK BYRE.

This consists of 4 units of "A" type building and provided with a pucca cemented floor and a central feeding trough. The most useful and durable type of floor found by trials at Pusa is that consisting of brick on edge in Portland cement over a 3" layer of lime concrete and top cement ruled pointed. The central pucca trough is constructed in layers of cement concrete and cement plastered throughout. The neck chains on either side of the trough slide on a longitudinal bar $\frac{1}{4}$" in diameter. These longitudinal bars are tied by cross iron bars looped at each end and built in the masonry of the trough. The shed is provided with 18"×4" shallow drain both sides. led to the manure pit. The shed has no walls, but bamboo wattle or galvanized sheet can be fitted to any side for shelter if required.

The cost of this shed size 40' 0"×18' 6" will be about Rs. 1,550 as follows :—

		Rs.	A.	P.
1. Earthwork excavation for foundation—				
Feeding trough $1\times40'\times4'\ 6''\times6''$	=90 cft.			
Flooring $2\times40'\ 10''\times7'\times1\frac{1}{2}''$	=71 „			
Steel column foundations $5\times2\times1'\ 9''\times1'\ 6''\times3'$	=79 „			
TOTAL .	240 „ @ Rs. 4 per cent.	0	15	0
2. Concrete in cement mortar in foundation—				
First course : feeding trough $1\times40'\times4'\ 6''\times6''$ . .	=90 cft.			
Second course : feeding trough $1\times40'\ \frac{(3'\ 6''\ plus\ 4'\ 6'')}{2}\times2'\ 9''$	=440 „			
Foundation of steel columns $5\times2\times1'\ 9''\times1'\ 6''\times3'$.	=79 „			
TOTAL .	609 „			
Deduct—				
Cavity of feeding trough $1\times37'\times(2{\cdot}72$ rft.) .	=100 cft.			
Balance 509 cft. @ Rs. 55 per cent.		279	15	0
3. Brick on edge flooring set in Portland cement mortar over a 3" layer of concrete in lime mortar, top of edging cement ruled pointed—				
Both floorings $2\times40'\ 10''\times7'\ 6''$ =612 sft. @ 55·9 per cent.		218	11	0
4. Half-inch cement plaster 2 : 1—				
On top, sides and cavity of trough $1\times40'\times10'$	400 sft.			
Ends of trough, $2\left(\frac{3'\ 6''+4'\ 6''}{2}\right)\times2'$ . .	16 „			
TOTAL .	416 sft. @ Rs. 12 per cent.	49	15	0

	Rs.	A.	P.
5. Iron work complete—			
Cross bars in trough for tying bullocks 12 (5′×$\frac{3}{4}$″) = 7$\frac{1}{2}$ lb. each. Total 90 lb. @ Rs. 18, cwt.	14	6	0
6. Steel work on unit system, each unit measuring 18′6″×10′ length and to follow the detailed specifications given above. Four units of type "A" building @ lump sum of Rs. 169, f.o.r., Howrah	676	0	0
6A. Provision for one extra pair of columns and curved angle rafter to above specifications for end bay at lump sum of Rs. 72 f.o.r., Howrah	72	0	0
7. Railway freight from Howrah to Pusa Road, goods train, on item Nos. 6 and 6A and unloading charges at destination, lump sum	60	0	0
8. Erection charges of 4 units including end-bay pair, lump sum .	13	0	0
9. Fixing and fitting galvanized corrugated iron sheets on roof, labour only. Whole shed, 1×42′×23′ 2″ = 973 sft. @ Rs. 3·8 per cent. .	34	1	0
10. Saucer shaped 18″×4″ manure drain with cement concrete and cement plaster. Cross section. 			
Long sides of shed 2×40″×10′ = 81′ 8″ rft. End side of shed 1×21′ 10″ = 21′ 10″ rft. Up to manure pit, say 1×20′ = 20′ rft.			
TOTAL . 123$\frac{1}{2}$ rft. @ Re. 1, rft. .	123	8	0
11. Site cleaning, etc., lump sum	15	0	0
TOTAL .	1,557	7	0

(Rupees one thousand, five hundred and fifty seven and annas seven only.)

4. SPECIFICATION FOR BULL SHED.

Two units of "A" type are constructed each in a fenced enclosure measuring 40 ft. × 25 ft. each. The wire fencing is No. 1150, "Ideal wire woven" 11 strands and fixed in 2″ × 2″ × ¼″ × 6′ long angle iron posts, the corner standard being 2½″ × 2½″ × ¼″ × 6′ angle irons. The shed including cost of fencing will cost about rupees seven hundred as follows:—

		Rs.	A.	P.
1. Earthwork excavation for foundation :—				
Steel columns 6 × 1′ 9″ × 1′ 6″ × 3′	47 cft.			
Foundation of posts at corners				
6 × 2′ × 2′ × 1′ 6″	= 36 „			
„ intermediate				
14 × 1′ 6″ × 1′ 6″ × 1′ 6″	= 47 „			
„ stays				
12 × 1′ 6″ × 1′ 6″ × 1′ 6″	= 40 „			
TOTAL .	170 „ @ Rs. 4, per cent.	0	11	0
2. Concrete in cement mortar in foundation.				
Steel columns 47 cft. @ Rs. 55, per cent.		25	14	0
3. Concrete in lime mortar in foundation.				
Fencing posts, all as above, 123 cft. @ Rs. 29, per cent. .		35	11	0
4. Wrought iron work for standards complete.				
Angle corner posts (2½″ × 2½″ × ¼″ × 6′.)				
6 @ 24·25 lb. each . .	146 lb.			
„ intermediate posts (2″ × 2″ × ¼″ × 6′.)				
26 @ 19·14 lb. each . .	498 „			
Bottom pins ½″ diam., rod 9″ long				
32 × ¾′ = 24′ @ ·668 lb. rft. .	16 „			
TOTAL .	660 „ @ Rs. 18, per cwt.	106	1	0
5. Galvanized staples 360 @ Re. 1, per cent.		3	10	0
6. Galvanized ideal wire woven farm fencing 11 strands No. 1150, 225 rft. @ As. 3-6, per rft.		49	3	0
7. Straining and fixing wire fencing, lump sum		5	0	0
8. Two units of "A" type. (Each unit to follow the detailed specifications given) @ Rs. 169 each, f. o. r., Howrah . . .		338	0	0
8A. Extra pair of columns and a curved rafter to above specifications for end bay, lump sum @ Rs. 72, f. o. r., Howrah . . .		72	0	0
9. Railway freight on iron material from Howrah to Pusa Road by goods train, lump sum		30	0	0
10. Erection of two units, complete, lump sum . . .		7	0	0
11. Fixing and fitting galvanized corrugated iron sheets on roof—Labour only.				
Whole shed 1 × 22′ × 23′ 2″ = 510 sft. @ Rs. 3-8, per cent. .		17	14	0
12. Site cleaning		5	0	0
TOTAL .		696	0	0

(Rupees six hundred and ninety six only.)

5. SPECIFICATION FOR MILK ROOM.

This is to be constructed of one unit "A" Type; only one end is filled in with half-brick wall. The other three sides are fitted with fly-proof netting in angle iron frame with a door facing cowshed. The floor is to be cement plastered. Cost of this milk room is rupees five hundred and fifty.

				Rs.	A.	P.
1. Earthwork excavation for foundation—						
Steel columns $4 \times 1' 9'' \times 1' 6'' \times 3 = 32$ cft. @ Rs. 4, per 1,000				0	2	0
2. Cement concrete in foundation—						
Foundation of steel columns 32 cft. @ Rs. 55, per cent.				17	10	0
3. Iron work per unit—The units to follow the detailed specifications given in preceding pages—						
One unit of type "A" @ Rs. 169, f.o.r., Howrah				169	0	0
3A. Extra pair of columns and a curved rafter to above specifications for end bay @ lump sum Rs. 72, f.o.r., Howrah				72	0	0
4. Railway freight on iron material from Howrah to Pusa Road by goods train, lump sum				20	0	0
5. Erection charges of one unit, including end bay, frame, lump sum				4	0	0
6. Fixing and fitting G. C. I. sheets on roof. Labour only.						
Whole roof $1 \times 10' \times 23' 2'' = 232$ sft. @ Rs. 3-8, per cent.				8	2	0
7. 32 S. w. g., 22 mesh fly-proof netting, complete.—						
Sides $2 \times 16' 4'' \times 8'$	261 sft.					
Gables $2 \times 16' 4'' \times 4'$ mean	131 „					
End $1 \times 10' \times 8'$	80 „					
	472 „					
Add 10 per cent. for wastage	48 „					
TOTAL	520 „	@ 4 as. per sft.		130	0	0
				420	14	0

8. Iron for frame for gauge work—

	lb.		
Bottom of door L. $2'' \times 2'' \times \frac{1}{4}'' \times 11'$.			
1 @ 3·22 lb. rft.	34·4		
Top of door L. $2\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{1}{4}'' \times 11'$.			
1 @ 4·07 lb. rft.	44·8		
Vertical sides of door L. $2'' \times 2'' \times \frac{1}{4}'' \times 6'$.			
2 @ 3·22 lb. rft.	38·6		
Long sides horizontal L. $2'' \times 2'' \times \frac{1}{4}'' \times 17'$.			
2 @ 3·22 lb. rft.	109·5		
Long sides vertical L. $2'' \times 2'' \times \frac{1}{4}'' \times 8'$.			
2 @ 3·22 lb. rft.	51·5		
Door frame L. $1\frac{1}{2}'' \times 1\frac{1}{2}'' \times \frac{1}{4}'' \times 34'$.			
1 @ 2·33 lb. rft.	79·3		
	358·1		
5 per cent. extra for bolting work.	18 4		
TOTAL	376·5		
3·36 cwt. @ 18 per cwt.			60 8 0

	Rs.	A.	P.
9. 3″ beaten concrete over a brick flat top cement ½″ plastered floor. Whole floor 1 × 11′ × 18′ 6″ = 204 sft. @ Rs. 23, per cent. .	46	15	0
10. Site cleaning, lump sum	2	0	0
TOTAL .	530	5	0

(Rupees five hundrd and thirty and annas five only).

6. SPECIFICATION FOR FOOD PREPARING GODOWN, GRAIN GODOWN AND IMPLEMENT SHED.

This is an open shed, consists of six units of "A" type. The central two units of godown are provided with a half brick wall around and right up to eaves. An expanded metal in angle iron frame double 10' × 5' door is provided between the full space of two columns in the northern side. (See plan). Brick on edge over a brick flat, top cement pointed floor is provided, only in the central two units of godown, unless otherwise necessity arises for the subsidiary units. Approximate cost of this shed would be Rs. 1,650 (Rupees one thousand, six hundred and fifty) as shown below :—

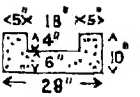
			Rs.	A.	P.
1. Earthwork excavation for foundation—					
Steel columns 14 × 1′ 9″ × 1′ 6″ × 3′	110 cft.	@ Rs. 4, per 1,000	0	7	0
2. Concrete in cement mortar in foundation—					
Foundation of steel columns as above.	110 cft.	@ Rs. 55, per cent.	60	8	0
3. Brick on edge set in lime mortar over a brick flat in lime mortar top of edging cement ruled pointed floor—					
Central 2 units — 1 × 20′ 4″ × 18′ 6″ = 376 sft.		@ Rs. 28, per cent.	105	4	0
4. First class brick work in lime mortar superstructure—					
Front long wall 1 × 10′ 5″ × 8′	= 33 cft.				
Rear long wall 1 × 20′ 5″ × 8′	= 67 ,,				
Front wall above door 1 × 10′ × 5″ × 2′	8 ,,				
End walls 2 × 16′ 4″ × 5″ × 8′	109 ,,				
Gables 2 × 16′ 4″ × 5″ × 2′ mean	27 ,,				
TOTAL .	244 cft.	@ Rs. 35-9, per cent.	86	12	0
5. Cement ruled pointing—					
Front long wall 2 × 10′ × 8′ .	160 sft.				
Front above door 2 × 10′ × 2′	40 ,,				
Rear long wall 2 × 20′ × 8′ .	320 ,,				
End walls 2 × 2 × 16′ 4″ × 8′	523 ,,				
Gables 2 × 2 × 16′ 4″ × 2′ mean	40 ,,				
TOTAL .	1,174 ,,		52	13	0
6. Angle iron for door fitted and fixed, complete—					
Top angle iron 3″ × 3″ × ¼″.					
1 × 10′ @ 4·9 lb. . .	49 lb.				
Bottom angle iron 3″ × 2″ × ¼″.					
1 × 10′ @ 4 lb. . .	40 ,,				
Door frame angle 1½″ × 1½″ × ¼″					
(2 × 2) 22′ = 88′ @ 2·33 lb.	205 ,,				
M. S. Hoops, 12 b. w. g. 1″ wide,					
4 × 22′ = 88′ @ ·337 lb..	30 ,,				
Bolts and nuts @ 5 per cent.	16 ,,				
TOTAL .	340 ,,	@ Rs. 18, per cwt. .	54	10	0

		Rs.	A.	P.
7. Expanded metal work, complete—				
Double door 1×9′ 3″×6′ . 56 sft.				
Extra for wastage 10 per cent. 6 „				
62 „ @ 8 as. per sft. .	31	0	0	
8. Iron work per unit of 18′ 6″ × 10′ length. Each unit to follow detailed specification given above—				
Six units "A" Type @ Rs. 169, f. o. r., Howrah . .	1,014	0	0	
8A. *Add* for an extra pair of columns and a curved angle rafter to above specifications @ lump sum, Rs. 72 . . .	72	0	0	
9. Railway freight on iron material from Howrah to Pusa Road by goods train, lump sum, Rs. 100	100	0	0	
10. Fixing and erection charges of units, lump sum . . .	20	0	0	
11. Fixing and fitting iron sheets on roof. Labour only—				
Whole shed. 1×62′×23′ 2″=1,436 sft. @ Rs. 3-8. per cent.	50	0	0	
12. Site cleaning, lump sum, Rs. 5	5	0	0	
TOTAL .	1,650	10	0	

(Rupees one thousand, six hundred and fifty and annas ten only.)

7. SPECIFICATION FOR CALF BOXES.

Two units of "A" type building. It has a half-brick wall right up to eaves in three sides leaving the fourth facing Milk Shed open. The cost will be rupees seven hundred and twenty five. The details are given below :—

	Rs.	A.	P.
1. Earthwork excavation for foundation—			
Steel columns $6 \times 1'9'' \times 1'6'' \times 3'$ = 47 cft. @ Rs. 4. per 1,000.	0	3	0
2. Concrete in cement mortar in foundation—			
Foundation of steel columns 47 cft. @ Rs. 55, per cent..	25	14	0
3. Brick on edge on a brick flat, both in lime mortar top of edging cement ruled pointed,—			
Flooring, $1 \times 20'\ 10'' \times 18'$. = 375 sft. @ Rs. 25, per cent.	93	12	0
4. First class brick work in lime mortar in superstructure—			
Long walls, rear $1 \times 20' \cdot 5'' \times 8'$ = 67 cft.			
End walls, $2 \times 16'\ 4'' \times 5'' \times 8'$ = 109 „			
Gables $2 \times 16'\ 4'' \times 5'' \times 2'\ 6''$ mean 34 „			
TOTAL . 210 „ @ Rs. 35-9, per cent.	74	11	0
5. Cement ruled pointing—			
Long walls, both sides, rear $1 \times 2 \times 20' \times 8'$ . . = 320 sft.			
End walls, both sides, rear $2 \times 2 \times 16'\ 4'' \times 8'$. = 523 „			
Gables, both sides, rear $2 \times 2 \times 16'\ 4'' \times 2'$ mean = 131 „			
TOTAL . 974 „ @ Rs. 4-8, per cent.	43	13	0
6. Two units of "A" type @ Rs. 169 each, f. o. r., Howrah (Iron work of each unit as per general specification given) . .	338	0	0
6A. *Add* for an extra pair of columns and a curved rafter for end bay at a lump sum of Rs. 72, f. o. r., Howrah . . .	72	0	0
7. Railway freight on iron material from Howrah to Pusa Road by goods train, lump sum, Rs. 34	34	0	0
8. Erection of 2 units, lump sum, Rs. 7	7	0	0
9. Fixing and fitting of iron sheets on roof. Labour only—			
Whole roof. $1 \times 22' \times 23'\ 2''$ = 510 sft. @ Rs. 3-8, per cent. .	17	14	0
10. Saucer shaped drain 18"×4" in cement concrete and plastered throughout—			
Cross section  12 rft. @ Re. 1, rft. .	12	0	0
11. Site cleaning, lump sum, Rs. 5	5	0	0
TOTAL .	724	3	0

(Rupees Seven hundred and twenty four and annas three only.)

8. SPECIFICATION FOR MILK COW BYRE.

This is similar to Bullock Byre in every respect, the only addition being the side passages and 5 ft. high walls beside them. The walls are of first class bricks in lime mortar and cement ruled pointed both sides. Top of these walls should be semi-circular only as other types of coping are liable to constant damage. The passages are provided with the same type of floor as that of the cattle standings. The complete shed including drain will cost nearly rupees two thousand as per details given below :—

		Rs.	A.	P.
1. Earthwork excavation for foundation :—				
Feeding trough $1 \times 40' \times 4' 6'' \times 6''$	= 90 cft.			
Flooring $2 \times 40' 10'' \times 7' \times 10\frac{1}{2}''$	= 71 „			
Steel columns $5 \times 2 \times 1' 9'' \times 1' 3'' \times 3'$	= 79 „			
Long walls $2 \times 40' 10'' \times 1' 3'' \times 1' 6''$	= 153 „			
TOTAL .	393 „ @ Rs. 4. per 1,000	1	9	0
2. Concrete in cement in foundation :—				
First course feeding trough $1 \times 40' \times 4' 6'' \times 6''$ . .	= 90 cft.			
Second course feeding trough $1 \times 40' \frac{(3' 6'' + 4' 6'')}{2} \times 2' 9''$	= 440 „			
Foundation of steel columns $5 \times 2 \times 1' 9'' \times 1' 6'' \times 3'$.	= 79 „			
TOTAL .	609 „			
Deduct cavity of trough 				
$1 \times 37' \times 2{\cdot}72$ sft.	100 cft.			
BALANCE .	509 „ @ Rs. 55, per cent.	279	15	0
3. Brick on edge flooring set in Portland cement mortar over a 3 inch layer of concrete in lime mortar, top of edging cement ruled pointed floor—				
Floorings of cattle standings $2 \times 40' 10'' \times 7' 6''$.	= 612 sft.			
Flooring at ends of troughs $2 \times 4' \times 5''$ . . .	= 3 „			
Floorings for passages, $2 \times 40' 10'' \times 6'$ . .	= 490 „			
TOTAL .	1,105 „ @ Rs. 35·9, per cent.	392	15	0
4. Half-inch cement plaster 2 : 1—				
On top, sides and cavity of trough $1 \times 40' \times 10'$ . .	= 400 sft.			
Ends of trough $2 \times \frac{(3' 6'' + 4' 6'')}{2} \times 2$	= 16 „			
TOTAL .	416 „ @ Rs. 12, per cent.	49	15	0

		Rs.	A.	P.
5.	Wrought iron work, complete—			
	Cross bars in trough for tying cattle 12 · (5′×$\frac{3}{4}$″ diam.× 7½ lb.). . . . =90 lb. @ Rs. 18 per cwt. .	14	6	0
6.	First class brick work in lime mortar superstructure.			
	Side walls 2 × 40′ 10″×1′ 3″×6′ 6″ =664 cft. @ Rs. 35 9. per cent.	236	2	0
7.	Cement ruled pointing—			
	Side walls 2×2×40′ 10″×5′ = 817 sft.			
	Top walls 2 × 40′ 10″×1′ 3″ = 102 ,,			
	End of walls 4×1′ 3″ × 5′ . = 25 ,,			
	TOTAL . 944 ,, @ Rs. 4-8 per 100 .	42	8	0
8.	Iron work per unit of 18′ 6″×10′ length, each unit to follow detailed specifications given. Four units of type "A" @ Rs. 169 each, f. o. r., Howrah	676	0	0
8A.	Provision for an extra pair of columns and a curved rafter to above specifications for end bay @ Rs. 72 each, f. o. r., Howrah .	72	0	0
9.	Railway freight on iron work from Howrah to Pusa Road by goods train	60	0	0
10.	Erection charges of 4 units and extra pair, lump sum . . .	13	0	0
11.	Fixing and fitting G. C. I. sheets on roof. Labour only.			
	Whole shed 1×42′×23′ 2″ =973 sft. @ Rs. 3-8, per cent.	34	1	0
12.	Saucer shaped 18″×4″ manure drain with cement concrete and cement plaster, cross section— 			
	Long sides of shed 2×40′ 10″ =81′ 8″ rit.			
	End of shed 1×21′ 10″ =21′ 10″ ,,			
	Up to manure pit, say 1×20′ =20′ ,,			
	TOTAL . 123′ 6″ ,, @ Re. 1 a foot .	123	8	0
13.	Site cleaning, lump sum, Rs. 10	10	0	0
	GRAND TOTAL .	2,005	15	0

(Rupees two thousand and five and annas fifteen only.)

9. SPECIFICATION FOR WELL AND WATERING TROUGH.

These are constructed in lime masonry at a convenient place between all the cattle sheds. The cost of construction including cost of semi rotary pump which is to be fixed into the well for pumping out water will be about rupees seven hundred as enumerated below :—

	Rs.	A.	P.
1. Earthwork excavation—			
Well excavation 1 $15'6''^2 \times \frac{\pi}{4} \times 24 = 4.530$ cft. @ Rs. 7-8 per 1,000	34	9	0
2. *Jamun* wood curb. complete $1 \times 8\frac{1}{4}' \times \pi \times 1\frac{1}{4}' \times \frac{3}{8}' = 20.25$ cft. @ Rs. 2-12. per cft.	55	11	0
3. First class brick work in lime mortar well masonry including out bricks $1 \times 8\frac{1}{4}'\pi \times 1\frac{1}{4}' \times 32' = 1,037$ @ Rs. 39-5 per cent.	407	11	0
4. Sinking well. complete 8 r.ft. @ Rs. 3, per rft.	24	0	0
5. Earth filling and dressing including cement plaster on top of well	20	0	0
6. Earthwork excavation for foundation—			
Watering trough $1 \times 20' \times 3'8'' \times 6'' = 37$ cft. @ Rs. 4, per 1,000	0	2	0
7. First class brick work in lime mortar in foundation—			
First course 1 $20' \times 3'8'' \times 9'' = 55$ cft. @ Rs. 34-5, per cent.	18	14	0
8. First class brick work in cement mortar in foundation—			
Surface $1 \times 20' \times 3'8'' \times 3'' = 18$ cft.			
Long walls, $2 \times 20' \times 10'' \times 1'6'' = 50$ „			
End walls $2 \times 2' \times 10'' \times 1'6'' = 5$ „			
TOTAL . 73 „ @ Rs. 56-13, per cent.	41	8	0
9. Cement ruled pointing—			
Exterior sides $2 \times 20' \times 2' = 80$ „			
Ends $2 \times 3'8'' \times 2' = 15$ „			
Top and cavity $1 \times 20'3'' \times 8'' = 73$ „			
Cavity sides $1 \times 42'8'' \times 1'6'' = 64$ „			
232 „ @ Rs. 4-8, per cent.	10	7	0
10. Cost of 2″ diameter semi-rotary pump including railway freight .	50	0	0
11. Cost of pipes, etc. and labour for fitting .	15	0	0
12. Site cleaning, lump sum	2	11	0
TOTAL .	680	0	0

(Rupees six hundred and eighty only.)

10. SPECIFICATION FOR YOUNG AND DRY STOCK BYRE.

This will be of 4 units of "A" type building, open each side. Bamboo wattle or some substantial weather board can however be provided in any side to protect the animal from monsoon where so desired. Feeding trough should be provided transversely as shown in the drawing. This shed with a space of 40 ft. × 18 ft. 6 in. would cost something near Rs. 1,300 as per detail given below :—

		Rs.	A.	P.
1. Earthwork excavation for foundation—				
Steel columns				
(5×2) 1′ 9″×1′ 6″ × 3′ .	=79 cft.			
Feeding trough sides				
2×17′ 6″×2′ 8″×6″ .	=47 „			
Feeding trough central				
1×17′ 6″ × 5′ 1″ 6″ .	=44 „			
	170 „ @ Rs. 4, per 1,000	0	11	0
2. Concrete in cement mortar in foundation—				
Steel columns as above .	=79 cft.			
1st course, feeding trough, side	=47 „			
1st course, double feeding, central	=44 „			
2nd course, feeding trough, side $2\times17'\ 6''\times\frac{(24''+32'')}{2}\times1'\ 9''$	=143 „			
2nd course, double, central, single $1'\times17'\ 6''\times\frac{(4'\ 4''+5')}{2}1'\ 9''$	=143 „			
Central partition walls.				
1×17′ 6″×5″×3′ .	= 22 „			
TOTAL .	478 „			
Deduct cavity of all troughs (22½ × 2′ 9″)				
4×15′ 9″×1·05 sft. .	66 cft.			
BALANCE .	412 „ @ Rs. 55, per cent.	226	10	0
3. Half inch, cement plaster 3 : 1—				
Exterior sides of all troughs, long walls 4×17′ 6″ × 1′ × 10″.	=192 sft.			
Top of all troughs, long wall 6×17′ 6″×5″ . . .	=44 „			
Top of all troughs, ends 4×1′ 10″×5″. . . .	=3 „			
Top of all troughs, central 2×4′ 2″×5″	=4 „			

		Rs.	A.	P.
Ends of troughs (side) $4 \frac{(32''+24'')}{2} 1' 9''$.	= 16 sft.			
Ends of troughs, central $2 \frac{(5'+4' 4'')}{2} 1' 9''$ . .	= 16 „			
Cavity of all troughs $4 \times 16' 4'' \times 2' 10''$ . .	= 185 „			
Partition wall, sides only $2 \times 17' 6'' \times 3'$ . .	= 105 „			
Partition wall, top and ends $(17\frac{1}{2}' + 6')$ sft.. . .	= 24 „			
TOTAL .	589 „ @ Rs. 10, per cent.	58	14	0
4. Iron work per unit of $18' 6'' \times 10'$, each unit to follow the detailed specification given above for one unit—				
Four units of "A" type @ Rs. 169 each unit, f. o. r., Howrah		676	0	0
4A. One extra pair of columns and a curved rafter to above specifications for end bay @ Rs. 72, lump sum, f. o. r., Howrah . .		72	0	0
5. Railway freight on iron from Howrah to Pusa Road . . .		60	0	0
6. Erection charges of 4 units, including end bay columns . .		13	0	0
7. Fixing and fitting G. C. I. on roof. Labour only. Whole shed $1 \times 42' \times 23' 2'' = 973$ sft. @ Rs. 3-8, per cent. .		34	1	0
8. Site cleaning, etc., lump sum		5	0	0
TOTAL .		1,146	4	0

(Rupees one thousand, one hundred and forty six and annas four.)

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FOR

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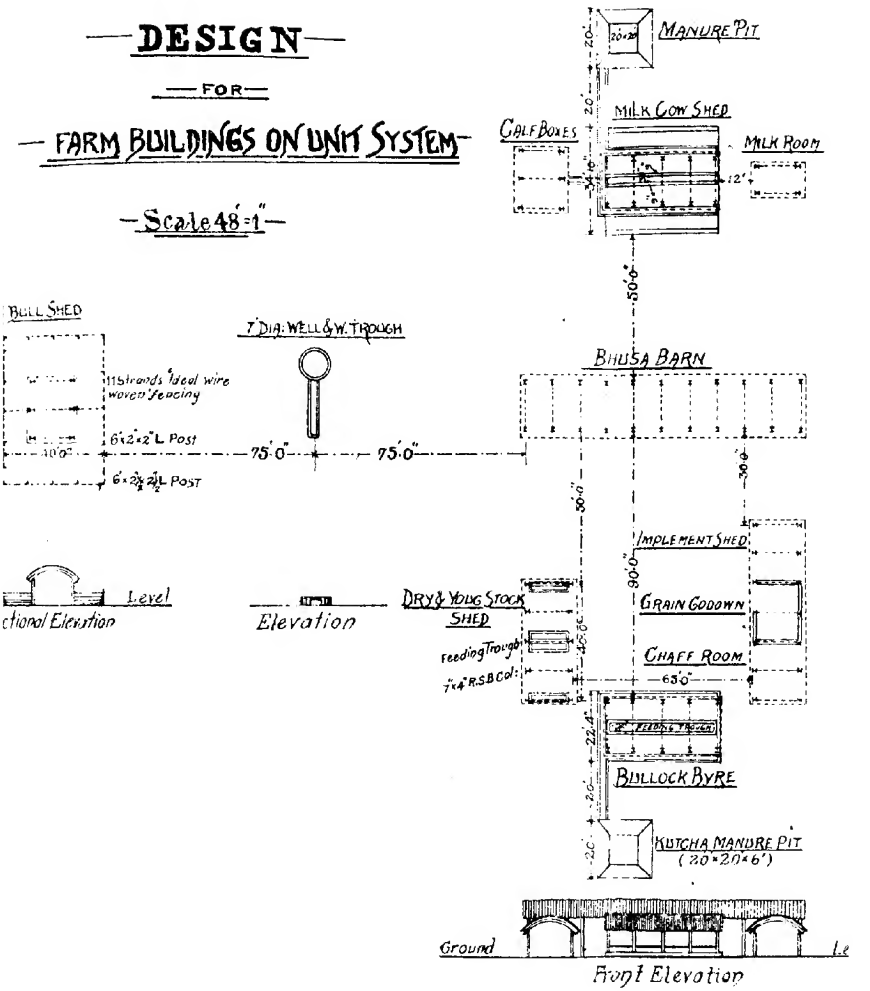

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